

Claims:

1. A method of assembling a pulley apparatus with built-in roller clutch for use in belt transmission of an auxiliary machinery of an engine, the pulley apparatus comprising a pulley member, a shaft member provided on the radially inner side of the pulley member, a first ball bearing provided between the pulley member and the shaft member on one side in the axial direction thereof, a second ball bearing provided between the pulley member and the shaft member on the other side in the axial direction thereof, and a roller clutch provided between the pulley member and the shaft member,
 - a. the first ball bearing comprising an outer diameter section provided in the inner peripheral portion of the pulley member and having a first outer raceway in the inner peripheral surface thereof, an inner diameter section provided in the outer peripheral portion of the shaft member and having a first inner raceway in the outer peripheral surface thereof, and a plurality of first balls provided between the first inner raceway and the first outer raceway,
 - b. the second ball bearing comprising an outer race separated from the pulley member, fitted into the inner peripheral surface of the pulley member and having a second outer raceway in the inner peripheral surface

thereof, an inner race fitted onto the outer peripheral surface of the shaft member to cooperate with the shaft member to form a shaft member unit and having a second inner raceway in the outer peripheral surface thereof, and a plurality of second balls provided between the second inner raceway and the second outer raceway,

c. the roller clutch adapted to be locked in one of the rotation directions and unlocked in the other of the rotation directions, and comprising an outer diameter section provided in the inner peripheral portion of the pulley member, an inner diameter section provided in the outer peripheral portion of the shaft member and having a cam portion on the outer peripheral surface thereof, a plurality of rollers provided between the outer peripheral surface of the inner diameter section and the inner peripheral surface of the outer diameter section, a retainer provided between the outer diameter section and the inner diameter section and having pockets to hold the rollers on the inside thereof, respectively, and a plurality of springs engaged with the retainer to press the rollers, respectively,

d. the retainer of the roller clutch having a falling-prevention means for preventing the rollers from falling off,

e. the outer diameter section of the roller clutch having a roller raceway

on the inner peripheral surface thereof,

f. the shaft member unit having a plurality of step portions two of which are used to form a means to regulate displacement in the axial direction of the retainer of the roller clutch,

g. at least one of the rollers and the roller raceway in the outer diameter section of the roller clutch being formed with a bevel at one end thereof to compress the springs simultaneously,

h. the method comprising of holding the rollers in the pockets in the retainer of the roller clutch and pressing the rollers with the springs engaged with the retainer, respectively, thereby forming an assembly with the retainer installed on the outer diameter side of the inner diameter section of the roller clutch,

i. then, simultaneously compressing the springs while utilizing the bevel to insert the outer diameter section of the roller clutch over the rollers in the assembly, and

j. then, mounting the plurality of second balls to between the inner peripheral surface of the pulley member and the outer peripheral surface of the shaft member.

2. A method of assembling a pulley apparatus with built-in roller clutch of claim 1, wherein in the state where the retainer of the assembly is

coaxially combined with the outer diameter section of the roller clutch, the total amount of the bevel at the end of the rollers and the bevel at the end of the roller raceway of the outer diameter section is larger than the amount by which the rollers project toward the radially outer side of the outer diameter section from the roller raceway provided on the inner peripheral surface of the outer diameter section.

3. A method of assembling a pulley apparatus with built-in roller clutch for use in belt transmission of an auxiliary machinery of an engine, the pulley apparatus comprising a pulley member, a shaft member provided on the radially inner side of the pulley member, a first ball bearing provided between the pulley member and the shaft member on one side in the axial direction thereof, a second ball bearing provided between the pulley member and the shaft member on the other side in the axial direction thereof, and a roller clutch provided between the pulley member and the shaft member,

a. the first ball bearing comprising an outer diameter section provided in the inner peripheral portion of the pulley member and having a first outer raceway in the inner peripheral surface thereof, an inner diameter section provided in the outer peripheral portion of the shaft member and having a first inner raceway in the outer peripheral surface thereof, and a plurality of

first balls provided between the first inner raceway and the first outer raceway,

b. the second ball bearing comprising an outer race separated from the pulley member, fitted into the inner peripheral surface of the pulley member and having a second outer raceway in the inner peripheral surface thereof, an inner race fitted onto the outer peripheral surface of the shaft member to cooperate with the shaft member to form a shaft member unit and having a second inner raceway in the outer peripheral surface thereof, and a plurality of second balls provided between the second inner raceway and the second outer raceway,

c. the roller clutch adapted to be locked in one of the rotation directions and unlocked in the other of the rotation directions, and comprising an outer diameter section provided in the inner peripheral portion of the pulley member, an inner diameter section provided in the outer peripheral portion of the shaft member and having a cam portion on the outer peripheral surface thereof, a plurality of rollers provided between the outer peripheral surface of the inner diameter section and the inner peripheral surface of the outer diameter section, a retainer provided between the outer diameter section and the inner diameter section and having pockets to hold the rollers on the inside thereof, respectively, and a

plurality of springs engaged with the retainer to press the rollers, respectively,

- d. the retainer of the roller clutch having a falling-prevention means for preventing the rollers from falling off,
- e. the shaft member unit having a plurality of step portions two of which are used to form a means to regulate displacement in the axial direction of the retainer of the roller clutch,
- f. the method comprising of holding the rollers in the pockets in the retainer of the roller clutch and pressing the rollers with the springs engaged with the retainer, respectively, thereby forming an assembly with the retainer installed in the inner diameter section of the roller clutch on the outer diameter side thereof,
- g. temporarily arranging a jig on the outer periphery of the rollers in the assembly, such that the jig has a means to press the rollers of the assembly radially inward of the assembly,
- h. then, mounting the outer diameter section of the roller clutch around the assembly while pushing the rollers with the jig radially inward of the assembly and simultaneously compressing the springs, and
- i. then, mounting the second ball bearing to between the inner peripheral surface of the pulley member and the outer peripheral surface of

the shaft member.

4. A method of assembling a pulley apparatus with built-in roller clutch of any one of Claims 1 to 3, wherein the second ball bearing is mounted to between the pulley member and the shaft member by a method selected from the group of pressure-fitting, crimping, welding and adhesion bonding.

5. A pulley apparatus with built-in roller clutch for use in belt transmission of an auxiliary machinery of an engine comprising a pulley member, a shaft member provided on the radially inner side of the pulley member, a first ball bearing provided between the pulley member and the shaft member on one side in the axial direction thereof, a second ball bearing provided between the pulley member and the shaft member on the other side in the axial direction thereof, and a roller clutch provided between the pulley member and the shaft member,

a. the first ball bearing comprising an outer diameter section provided in the inner peripheral portion of the pulley member and having a first outer raceway in the inner peripheral surface thereof, an inner diameter section provided in the outer peripheral portion of the shaft member and having a first inner raceway in the outer peripheral surface thereof, and a plurality of first balls provided between the first inner raceway and the first outer

raceway,

b. the second ball bearing comprising an outer race separated from the pulley member, fitted into the inner peripheral surface of the pulley member and having a second outer raceway in the inner peripheral surface thereof, an inner race fitted onto the outer peripheral surface of the shaft member to cooperate with the shaft member to form a shaft member unit and having a second inner raceway in the outer peripheral surface thereof, and a plurality of second balls provided between the second inner raceway and the second outer raceway,

c. the roller clutch adapted to be locked in one of the rotation directions and unlocked in the other of the rotation directions, and comprising an outer diameter section provided in the inner peripheral portion of the pulley member, an inner diameter section provided in the outer peripheral portion of the shaft member and having a cam portion on the outer peripheral surface thereof, a plurality of rollers provided between the outer peripheral surface of the inner diameter section and the inner peripheral surface of the outer diameter section, a retainer provided between the outer diameter section and the inner diameter section and having pockets to hold the rollers on the inside thereof, respectively, and a plurality of springs engaged with the retainer to press the rollers,

respectively,

- d. the retainer of the roller clutch having a falling-prevention means for preventing the rollers from falling off,
 - e. the outer diameter section of the roller clutch having a roller raceway on the inner peripheral surface thereof,
 - f. the shaft member unit having a plurality of step portions two of which are used to form a means to regulate displacement in the axial direction of the retainer of the roller clutch,
 - g. with the rollers and the roller raceway on the inner peripheral surface of the outer diameter section of the roller clutch, at least the roller raceway of the outer diameter section of the roller clutch being formed with a bevel at one end thereof to simultaneously compress the springs.
6. A pulley apparatus with built-in roller clutch of Claim 5, wherein in the state where the retainer of the assembly is coaxially combined with the outer diameter section of the roller clutch, the total amount of the bevel at the end of the rollers and the bevel at the end of the roller raceway of the outer diameter section is larger than the amount by which the rollers project toward the radially outer side of the outer diameter section from the roller raceway provided on the inner peripheral surface of the outer diameter section.

7. A pulley apparatus with built-in roller clutch of any one of Claims 5 and 6, wherein the second ball bearing is mounted to between the pulley member and the shaft member by a method selected from the group of pressure-fitting, crimping, welding and adhesion bonding.